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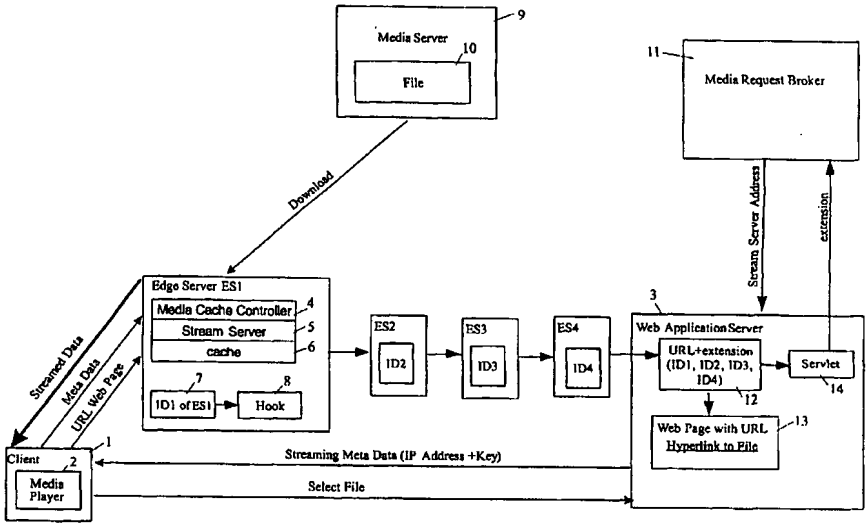
(54) Title: METHOD AND COMPUTER SYSTEM FOR SELECTING AN EDGE SERVER COMPUTER



(57) Abstract: Media Distribution within the Internet is done with the help of Application-Servers, Content-Servers and distributed Edge-Servers where the clients are connected to Media Distribution Services. A computer system is provided comprising client 1, having a Web browser with a media player 2, Web application server 3, content server, edge servers ES1 to ES4 and media request broker 11. After the client 1 has selected a media for streaming the media request broker 11 makes a determination concerning an appropriate edge server to perform the streaming operation. This determination is made based on an extension of the client's http request made by the edge server and passed from the application server to the media request broker.

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D E S C R I P T I O N

METHOD AND COMPUTER SYSTEM FOR SELECTING AN EDGE SERVER COMPUTER

The present invention relates to the field of data communication, in particular to distributing and streaming of data, for accessing digital information, including audio, video and business type information, at remotely stored locations and for communicating that information to a users premise.

From US 5,734,719 a system for accessing digital information over a computer network is known. The system contains a master server which is situated geographically so as to be accessible to network subscribers. It's geographic and network location is dependent upon communication network systems and subsystem cost and availability in order to best serve a customers premise, whether it's a retail store or similar point-of-sale or other end-user-location. Security mechanisms that require centralized database authorization prior to the transmission of content and/or the manufacture of any of the products is provided in addition.

New media data extends traditional computer data formats into more natural data formats for the interaction of humans and computers by incorporating images, motion pictures, voice, audio and video. One of the key problems with new media data is transferring the usually huge amounts of content through a network.

A stream server requires all data to be streamed to reside locally on the stream server. The connection bandwidth to the rendering client (media player) has to fulfill at least the requirements corresponding to the nature of the data to be transmitted. For this reason stream servers are placed on so called edge servers (the edge of the network in the connection path to the client; also referred to as the "last mile").

In order to initiate a streaming operation streaming meta data needs to be provided to the renderer client (media player) requesting the stream. The meta data or meta file usually contains at least an identification (key) of the media data to be streamed and the identification of the stream server e.g. the TCP/IP host name of the stream server machine and the port the stream server software listens to.

When a user wants to have media streamed to his client he normally "clicks" on a hyperlink identifying the media on the web page presented to him through his web browser. The web browser generates a http request containing the media identification information. As a response to that the application server sends the media meta data to the client's web browser. Based on that information the web browser typically invokes the corresponding media player which resides on a client and is responsible to receive the meta data from the network, negotiate connection to the stream server, receive and to render the data in parallel.

The way streaming technology is realized today, media players are only able to render streams from a corresponding stream server usually built by the same company. Examples of such proprietary stream formats are the IBM Video charger/Video

charger player, Apple quick time, Microsoft MediaServer/MediaPLayer and Real Networks G2 server/player.

A common problem of the prior art data transfer protocols, in particular streaming protocols over a computer network, such as the Internet, is the bandwidth required to perform a streaming operation.

It is thus an object of the present invention to provide an improved method and computer system for distributing content data to edge servers and in particular, to select an edge server or acceptable alternative edge server which is located topologically nearest to the client which requests the streaming service.

The object of the invention is achieved by the features stated in the enclosed independent claims to which reference should now be made. Further advantageous arrangements and embodiments of the invention are set forth in the respective sub claims.

The invention allows to determine an edge server location to which the client is connected while sending the request for streaming to the application server. This determination is done by adding information to the client's http request containing the media identifier on the way to it's Web application server which is contacted by the client to select a file for downloading and/or streaming.

Typically the Web application server is contacted by the client by inputting the corresponding uniform resource locator into the client's Web browser program. The connection between the client and the Web application server is provided by establishing a communication path including a plurality of

server computer nodes. The first server computer node in the path from the client to the Web application server is the server topologically closest to the client which can thus be expected to be an efficient edge server to provide the streaming services with the best performance and shortest latency time for the client.

In one embodiment of the invention this server - being the first node in the path from the client to the Web application server - is selected by the Web application server or an associated media request broker to be the server from which the download of the desired file is to be performed. The corresponding Meta data provided from the media request broker to the Web application server to the client contains data identifying the selected server.

In a further preferred embodiment the media request broker contains a file comprising a set of alternative servers being located in the same geographical or topological region as the first server node in the path between the client and the Web application server. In this case the server from which the download is to be performed is selected from the group comprising the set of servers in the same geographical / topological region as the node itself.

The selection of a particular server out of this group of servers is done based on a determination of a relative quality weight index of the server in the group. The relative quality weight can be determined based on one or more of the following criteria: availability of the desired media on the server, number of transactions in process, usage of processing resources and available bandwidth in the communication path to the client.

In a further preferred embodiment the other server computers in the path from the client to the Web application server are also taken into consideration for the selection of the particular server. In addition each of these additional servers can also have associated regional servers which can also be taken into consideration for determining an appropriate server to perform the download and/or streaming operation.

In a further preferred embodiment a server computer can contain stream servers of different data formats. If a media is available on that server computer in a format which is different to the format required by the requesting client this server computer can still be selected to be the server computer of choice. In this case the data format available on the server computer is transcoded "on the fly" to the desired format and then streamed to the client.

A particular field of application of the present invention is mobile communication, in particular with respect to digital telephony such as UMTS. In this case the client can be any mobile device, such as a mobile phone having an integrated MP3 player, a personal digital assistant or a portable computer, such as a Laptop or Palm top computer, having a wireless interface.

A particular advantage of the present invention is that by selecting a server based on it's quality weight the computer network can be balanced as far as the distribution of computing and/or bandwidth resources is concerned. The overall system throughput can thereby be optimized.

Brief description of the drawings

The present invention is illustrated by way of example and is not limited by the figures of the accompanying drawings in which:

Fig. 1 is a block diagram of a first embodiment of a computer system of the invention,

Fig. 2 is a block diagram of a second embodiment of a computer system of the invention; and

Fig. 3 is an embodiment of a method of the invention.

The computer system of Fig. 1 has a client 1. The client 1 has a web browser and a media player 2, for example an IBM Video charger player.

The client 1 can connect with the help of his web browser to Web application server 3 via a computer network, such as the Internet comprising the edge servers ES1, ES2, ES3, ES4 and other edge servers not shown in Fig. 1. The edge server ES1 has a media cache controller 4, stream server 5 and cache 6.

The stream server can be an IBM Video charger to interface with the corresponding media player 2 of client 1. The streaming operation is performed out of the cache 6. The media cache controller 4 controls and analyses the status and operation of stream server 5 and it's cache 6.

In particular media cache controller 4 evaluates a present system status to provide a quality weight indicating the loading of the system. The quality weight can include one or

more of the following criteria: availability of the selected file in the cache 6, available bandwidth for connecting to the client 1, percentage of processing resources of the edge server ES1 and/or other criteria.

Further the edge server ES1 has a memory 7 for storage of the identifier ID1 of the edge server ES1. Hook 8 is coupled to the memory 7.

Each of the edge servers passes the http requests and responses of the client and the web application server back and forth. For every http request coming from the client the edge server calls the hook 8 and passes this http request to it.

The hook examines this http request for a unique signature which identifies the request as a media request. If the hook identifies this signature it appends it's identifier ID1 to the http request and passes the request back to the edge server. The edge server sends it to the next edge server ES2.. ESn - if there is one - or to the application server.

The further edge servers ES2, ES3 and ES4 in the communication path between the client 1 and the Web application server 3 are of the same or a similar constitution than edge server ES1.

The computer system of Fig. 1 further includes media server 9 which stores the selected media 10. Media server 9 can be coupled to anyone of the edge servers ES1 to ES4 for downloading the media 10 to the corresponding edge server.

Web application server 3 is coupled to media request broker 11. The media request broker 11 selects one of the edge

servers ES1 to ES4 or another edge server to perform the streaming operation of the desired data to client 1. Based on this selection of a server by media request broker 11 the Web application server generates the Meta data for the client 1.

The Web application server has a memory 12 for at least temporarily storing the http request of the client augmented by data indicative of one or more of the edge servers comprised in the communication path between the client 1 and the Web application server 3.

The Web application server further contains servlet 14 which is invoked through this http request when client 1 clicks on the Hyperlink to a media 10.

In operation client 1 clicks on a hyperlink within a Web page 13 in it's Web browser program in order to request the desired media from the Web application server 3 via the Internet. As already explained in detail above the web browser generates the corresponding http request which is routed through the edge servers ES1 to ES4 such that a communication path including those edge servers results.

As the communication path is build up the hook 8 of edge server ES1 adds information to the http request to add it's identifier ID1 to the request. Likewise the further edge servers ES2 to ES4 also append corresponding data to the http request.

Thus the resulting http request is composed of the original URL plus data indicative of the identifiers ID1 to ID4.

Subsequently servlet 14 is invoked with all the information contained within the client's http request and it transfers at least the extension to the media request broker 11.

The media request broker has a variety of options to select an appropriate edge server as a server for streaming of the desired file 10 to client 1. One option is to select the edge server ES1 as the edge server which is closest to the client 1 in the communication path which has been established through the Internet to the Web application server 3.

It is assumed that the closest edge server ES1 also provides highest bandwidth. The identity of the edge server ES1 is determined by the media request broker by analyzing the appended extension provided by the hook running on each edge server ES1 to ESn.

Based on this information the media request broker 11 generates the Meta data which is required by client 1 to access a stream server. The Meta data includes the complete Network address of stream server 5 (e.g. IP-address and port) and a key for access to the desired media 10 is provided to client 1 by Web application server 3.

In response to receipt of the Meta data the client 1 connects to the edge server ES1, in particular to stream server 5, to invoke the streaming operation. In case the desired media 10 is already available in the cache 6 the streaming can start immediately.

If this is not the case first a download operation of the file 10 from the media server 9 to the cache 6 of the edge server ES1 needs to be initiated.

Alternatively the Media request broker can also take into consideration the further edge servers ES2 to ES4 as identified by the extension provided by Servlet 14. In either case Media request broker 11 evaluates the quality weights provided by the Media cache controllers 4 of the corresponding edge servers ES1 to ES4 to select the most suitable edge server.

For example the edge server ES2 may already contain the media 10 in it's cache 6 while the media 10 is not available in the cache 6 of the edge server ES1. In this case the quality weight of the edge server ES2 is greater than the quality weight of the edge server ES1 even though the edge server ES1 is closer to client 1 due to the fact that the edge server ES2 already has the required data.

Likewise edge server ES2 or another edge server can be selected by the Media request broker for other reasons, for example the edge server ES1 being overloaded, the stream server 5 of the edge server ES1 being down or not having the required data format.

Fig. 2 shows a further preferred embodiment of the invention wherein like elements are denoted by the same reference numerals. The edge server ES1 of the computer system of Fig. 2 has an additional media cache controller 15, stream server 16 and cache 17. The stream server 16 is capable of streaming a different format than stream server 5. Again edge server ES1 has memory 7 and hook 8.

As in the previous embodiment hook 8 serves to provide an extension to the http request provided by the client 1 to

append information indicative of the identifier ID1 of the edge server ES1.

On a second level of hierarchy the edge server ES1 has a media edge controller 18 which communicates with the media cache controllers 4 and 15 of the individual stream servers 5 and 16.

Further the computer system comprises the edge servers ES1a, ES1b, ES1c and ES1d which are located in the same geographical/topological region or area 19 of the edge server ES1. Likewise the other edge servers ES2 to ES4 can be associated to corresponding additional edge servers in their respective regions or areas.

This situation is reflected by the database 20 stored by the media request broker 11. The database 20 groups edge servers of each of the regions or areas; for example in case of the region 19 it assigns the edge server ES1 to the additional edge servers ES1a to ES1d. The database 20 can contain similar entries for the further edge servers ES2 to ES4.

When the media request broker 11 obtains the extension from servlet 14 it identifies the first edge server in the path between client 1 and Web application server 3 - which is the edge server ES1. In the next step media request broker 11 identifies the additional edge servers ES1a to ES1d being located in the same geographical/topological region 19 of the edge server ES1 by querying database 20.

Further the media request broker 11 obtains the relative quality weights from the media cache controllers and/or media edge controllers of the respective group of edge servers of

the region 19. The media request broker 11 selects the stream server providing the highest quality weight from this group of edge servers.

If the highest quality weight of a stream server of this group of edge servers is not sufficient, for example because it is below a predefined threshold value, the media request broker 11 performs an equivalent operation for the next edge server ES2 and the associated regional group of additional edge servers not shown in Fig. 2 to search for a stream server having a sufficient quality weight.

As a result of this process the media request broker 11 returns a stream server address to the Web application server 3 based on which the meta data for client 1 is generated.

In the embodiment of the Fig. 2 it is also possible for media request broker 11 to select - for example - Edge Server ES1 with stream server 16 even though the actual media to be streamed is only residing in the cache of stream server 5 in the format of stream server 5 which is not compatible to the format necessary for media player 2 at the client. This is due to the fact that the edge server ES1 has a transcoder program for transcoding the data provided by stream server 16 into the required format of the media player 2.

The transcoding is initiated by media request broker with a corresponding message to the media edge controller. In the example the requested media taken from the cache of Stream Server 16 is transcoded and the resulting media is stored in the cache of Stream Server 5. Subsequently a meta file is generated pointing to stream server 5 and the media would be streamed from stream server 5 to the media player.

With respect to Fig. 3 now a preferred embodiments of a method of the invention is explained in greater detail. In step 1 a client connects to a web page containing hyperlinks to media objects (e.g. Media files). In step 2 the client selects a media by clicking hyperlink.

In step 3 a Web Browser generates a http request containing the unique signature of the media request.

Step 4 is a for-next-loop containing the following steps 5, 6 and 7:

For all edge servers 1 to n:

Pass Http request to edge server ESm.
Invoke hook at edge server ESm.
Check hook if media request signature is present.
(Step 5)

In step 6 it is decided if a media request signature is present. If this is the case an ID of the edge server ESm is appended to the http request in step 7 and the control goes back to step 5 with an incremented m. Otherwise m is incremented directly and the control goes back to step 5 as long as m remains lesser or equal to n.

In step 8 the Http request arrives at the Web Application Server. Next in step 9 the Web Application Server invokes a servlet and passes a URL and the extension(s) of the Edge Servers to the Servlet.

The extension of the URL is accessed in step 10 by the servlet to provide the extension to the media request broker in step 11.

Based on the extension the media request broker determines quality weights of potential edge servers in step 12. A potential edge server is the first edge server in the communication path between the client and the Web page - which is edge server ES1 - or an edge server from a regional group of the edge server ES1 and/or one of the edge servers ES2 to ES4 and/or corresponding regional groups of the edge servers ES2 to ES4.

In step 13 the media request broker selects an appropriate edge server based on the quality weight as determined in step 12.

Based on the selected edge server corresponding media data is generated in step 14 which is send to the client in step 15.

The client connects to the edge server indicated in the meta data and provides the key to the edge server to initiate the streaming in step 160. The streaming actually starts in step 17.

Definitions

1. A method for selecting a first server computer for sending of data to a client computer, the method comprising the steps of:

- accessing a second server computer through a path in a computer network, the path comprising a first set of server computers,

- adding information indicative of at least one server computer of the first set of server computers to a locator of a resource on the second server computer, the resource having a unique signature as part of their identifier; and

- selecting the first server computer based on the information added to the locator.

2. The method of definition 1 the second server computer being a Web application server comprising a Web page with a Hyperlink referencing the data to be send to the client, the hyperlink including a unique signature, the method further comprising the step of selecting the Hyperlink by the client; subsequently generating an http request out of this hyperlink by a web browser; this http request containing the unique signature identifying the media request.

3. The method of definitions 1 or 2 further comprising the steps of:

- at least temporarily storing the information added to the locator on the second server computer,

- providing of the information to a Media Request Broker in response to a client's selection of the Hyperlink.

4. The method of anyone of definitions 1, 2 or 3 the media request broker selecting the first server computer based on the information.

5. The method of anyone of the preceding definitions further comprising the steps of:

- determining a quality weight of at least one of the server computers in the path,

- selecting the first server computer from the first set of server computers based on the quality weight.

6. The method of anyone of the preceding definitions further comprising the steps of:

- storing of a set of locators of a second set of server computers being in the same geographical /topological area as a server computer in the first set of server computers, and

- determining a quality weight of at least one of the server computers of the second set for selection of the first server computer.

7. The method of anyone of the preceding definitions further comprising the steps of:

- providing the media request broker with the information, the information being indicative of the server computer of the first set of server computers being the first node in the path,

- determining a quality weight based on the information for the first server computer node in the path and for the server computers of the second set of server computers belonging to that server computer node,

- selecting one of the server computers from the group comprising the first server computer node in the path and the set of second server computers with a quality weight being greater than a predefined threshold value,

- determining a quality weight of a second server computer node in the path in case none of the quality weights of the first group is sufficient.

8. The method of anyone of the preceding definitions the quality weights being determined based on one or more of the following criteria: availability of the data on a server computer, number of transactions in process on the server computer, percentage of processing resources in use on the server computer, communication bandwidth available in the communication link with the client.

9. A server computer system comprising a stream server (5, 16) and storage means (6, 17) for storing and/or buffering of data to be streamed to a client (1), means (7) for storing an identifier of the server computer and means (8) for adding information to a locator provided by the client, the information being indicative of the identifier.

10. The server computer system of definition 9 further comprising means for converting of the data from one stream format to another.

11. A computer system comprising a Web application server (3) and a media request broker (11), the Web application server containing a Web page (13) with a Hyperlink referencing a media (10) to be streamed to a client (1) and means (12) for at least temporarily storing of information indicative of a first node in a communication path between the client and the Web application server in a computer network, means (14) for providing the information to the media request broker upon selection of the Hyperlink by the client, and means (20) for selecting a stream server for streaming the data to the client based on the information.

12. A system for selecting a first server computer from a plurality of server computers for sending of data to a client, the system comprising means adapted for carrying out the steps of the method according to anyone of the preceding definitions 1 to 8.

13. A data processing program for execution in a data processing system comprising software code portions for performing a method according to anyone of the definitions 1 to 8 when the program is run on the computer.

14. A computer program product stored on a computer usable medium, comprising computer readable program means for causing a computer to perform a method according to anyone of the definitions 1 to 8 when the program is run on the computer.

C L A I M S

1. A method for selecting a first server computer for sending of data to a client computer, the method comprising the steps of:

- accessing a second server computer through a path in a computer network, the path comprising a first set of server computers,

- adding information indicative of at least one server computer of the first set of server computers to a locator of a resource on the second server computer, the resource having a unique signature as part of their identifier; and

- selecting the first server computer based on the information added to the locator.

2. The method of claim 1 the second server computer being a Web application server comprising a Web page with a Hyperlink referencing the data to be send to the client, the hyperlink including a unique signature, the method further comprising the step of selecting the Hyperlink by the client; subsequently generating an http request out of this hyperlink by a web browser; this http request containing the unique signature identifying the media request.

3. The method of claims 1 or 2 further comprising the steps of:

- at least temporarily storing the information added to the locator on the second server computer,

- providing of the information to a Media Request Broker in response to a client's selection of the Hyperlink.

4. The method of anyone of claims 1, 2 or 3 the media request broker selecting the first server computer based on the information.

5. The method of anyone of the preceding claims further comprising the steps of:

- determining a quality weight of at least one of the server computers in the path,

- selecting the first server computer from the first set of server computers based on the quality weight.

6. The method of anyone of the preceding claims further comprising the steps of:

- storing of a set of locators of a second set of server computers being in the same geographical /topological area as a server computer in the first set of server computers, and

- determining a quality weight of at least one of the server computers of the second set for selection of the first server computer.

7. The method of anyone of the preceding claims further comprising the steps of:

- providing the media request broker with the information, the information being indicative of the server computer of the first set of server computers being the first node in the path,

- determining a quality weight based on the information for the first server computer node in the path and for the server computers of the second set of server computers belonging to that server computer node,

- selecting one of the server computers from the group comprising the first server computer node in the path and the set of second server computers with a quality weight being greater than a predefined threshold value,

- determining a quality weight of a second server computer node in the path in case none of the quality weights of the first group is sufficient.

8. The method of anyone of the preceding claims the quality weights being determined based on one or more of the following criteria: availability of the data on a server computer, number of transactions in process on the server computer, percentage of processing resources in use on the server computer, communication bandwidth available in the communication link with the client.

9. A server computer system comprising a stream server (5, 16) and storage means (6, 17) for storing and/or buffering of data to be streamed to a client (1), means (7) for storing an identifier of the server computer and means (8) for adding information to a locator provided by

the client, the information being indicative of the identifier.

10. The server computer system of claim 9 further comprising means for converting of the data from one stream format to another.

11. The computer system of claim 9 or 10 further comprising a Web application server (3) and a media request broker (11), the Web application server containing a Web page (13) with a Hyperlink referencing a media (10) to be streamed to a client (1) and means (12) for at least temporarily storing of information indicative of a first node in a communication path between the client and the Web application server in a computer network, means (14) for providing the information to the media request broker upon selection of the Hyperlink by the client, and means (20) for selecting a stream server for streaming the data to the client based on the information.

12. A system for selecting a first server computer from a plurality of server computers for sending of data to a client, the system comprising means adapted for carrying out the steps of the method according to anyone of the preceding claims 1 to 8.

13. A data processing program for execution in a data processing system comprising software code portions for performing a method according to anyone of the claims 1 to 8 when the program is run on the computer.

14. A computer program product stored on a computer usable medium, comprising computer readable program means for causing a computer to perform a method according to anyone of the claims 1 to 8 when the program is run on the computer.

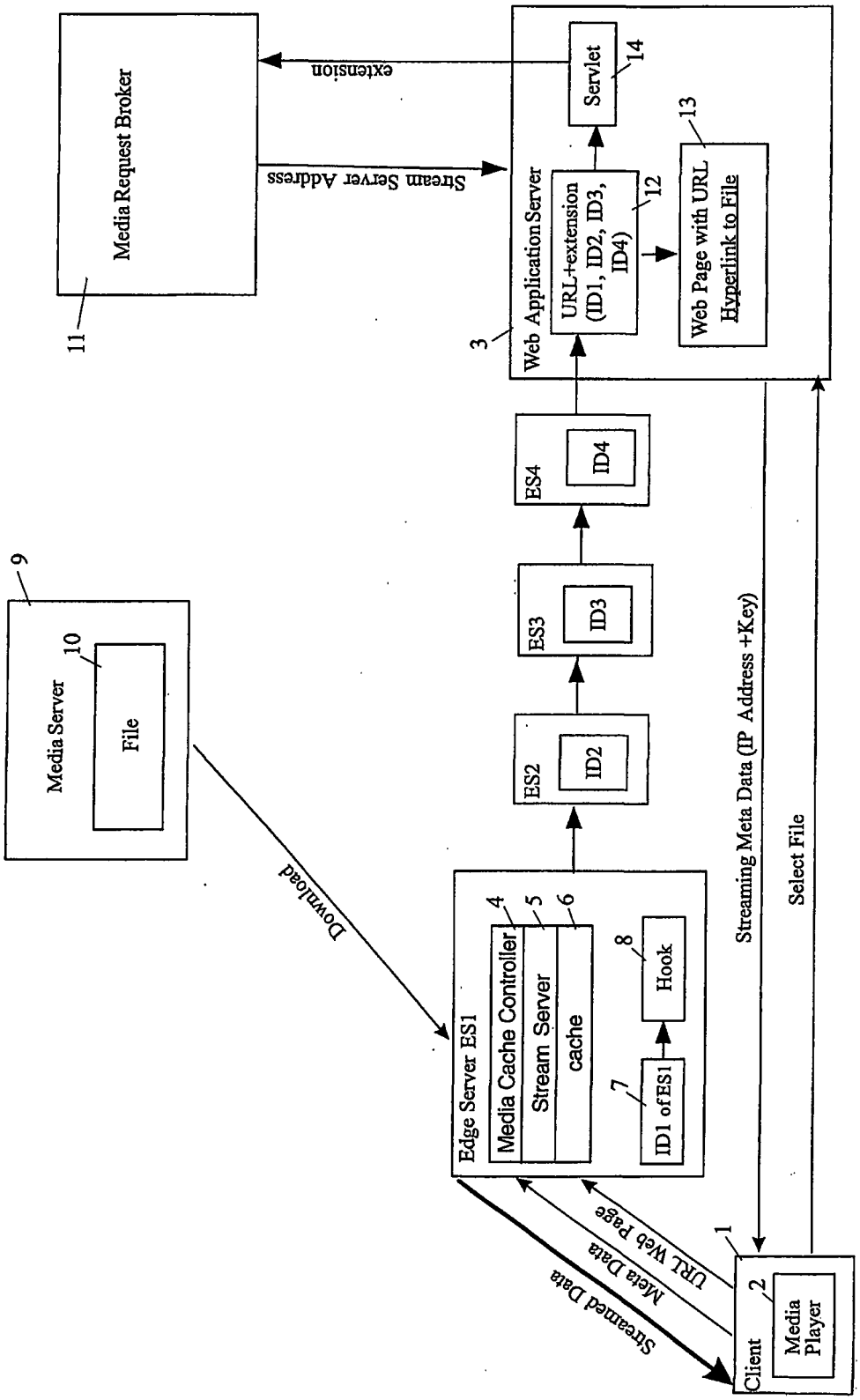
Client
Media Player
2
1
Streamed Data
Meta Data
URL Web Page
Edge Server ES1
Media Cache Controller
Stream Server
cache
4
5
6
Hook
8
ID1 of ES1
7
Download
Media Server
File
10
9
ES2
ID2
ES3
ID3
ES4
ID4
Streaming Meta Data (IP Address +Key)
Select File
Web Application Server
URL+extension (ID1, ID2, ID3, ID4)
12
Web Page with URL Hyperlink to File
13
Servlet
14
3
Stream Server Address
extension
Media Request Broker
11

FIG. 1

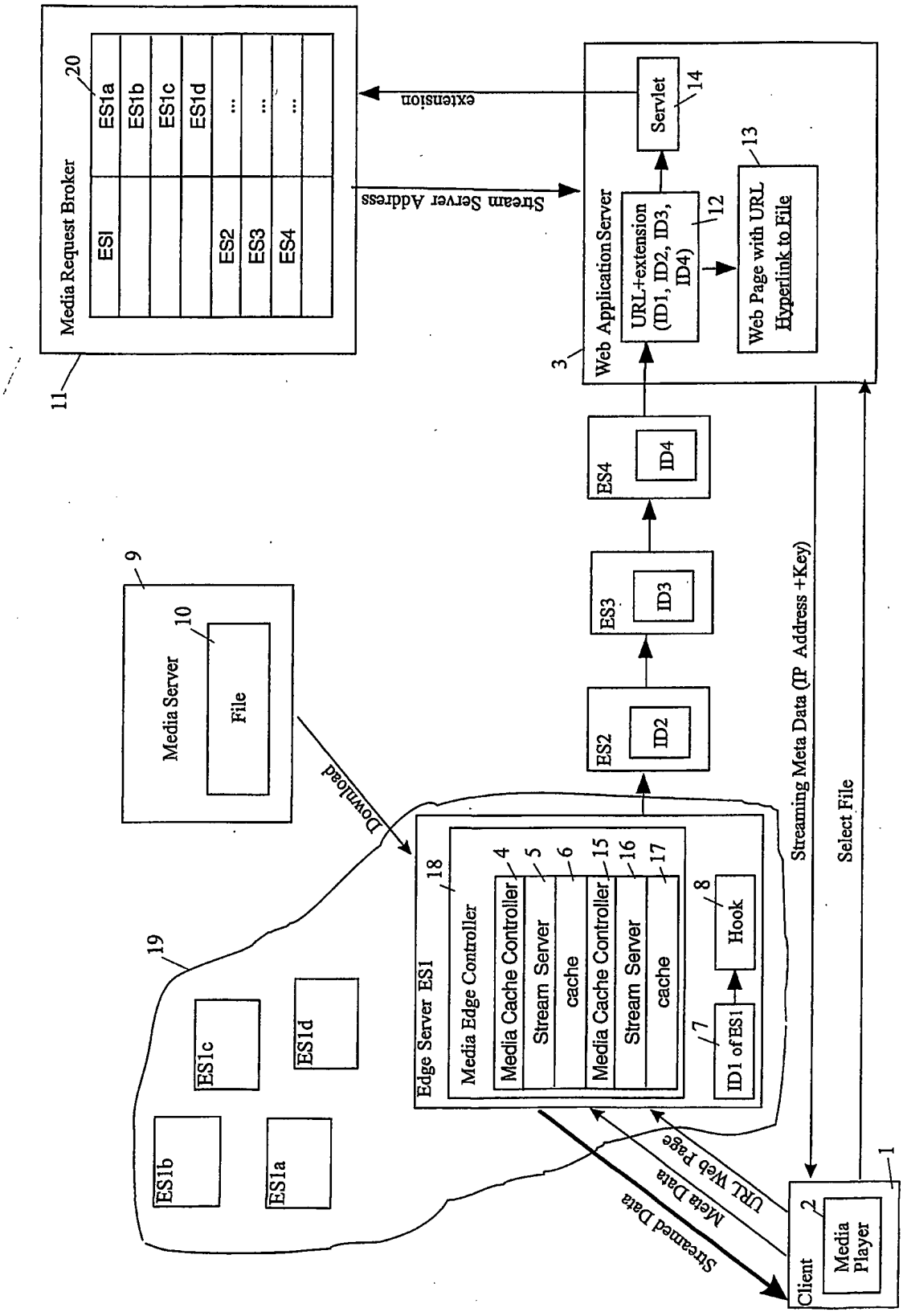
Media Request Broker
20
ES1a
ES1b
ES1c
ES1d
ES1
ES2
ES3
ES4
11
extension
Stream Server Address
Web Application Server
3
Servlet
14
URL+extension (ID1, ID2, ID3, ID4)
12
Web Page with URL Hyperlink to File
13
ES4
ID4
ES3
ID3
ES2
ID2
Media Server
9
10
File
Download
Edge Server ES1
18
Media Edge Controller
Media Cache Controller
4
Stream Server
5
cache
6
Media Cache Controller
15
Stream Server
16
cache
17
Hook
8
ID1 of ES1
7
19
ES1c
ES1d
ES1b
ES1a
Streamed Data
Meta Data
URL Web Page
Streaming Meta Data (IP Address +Key)
Select File
Client
2
Media Player
1

FIG. 2

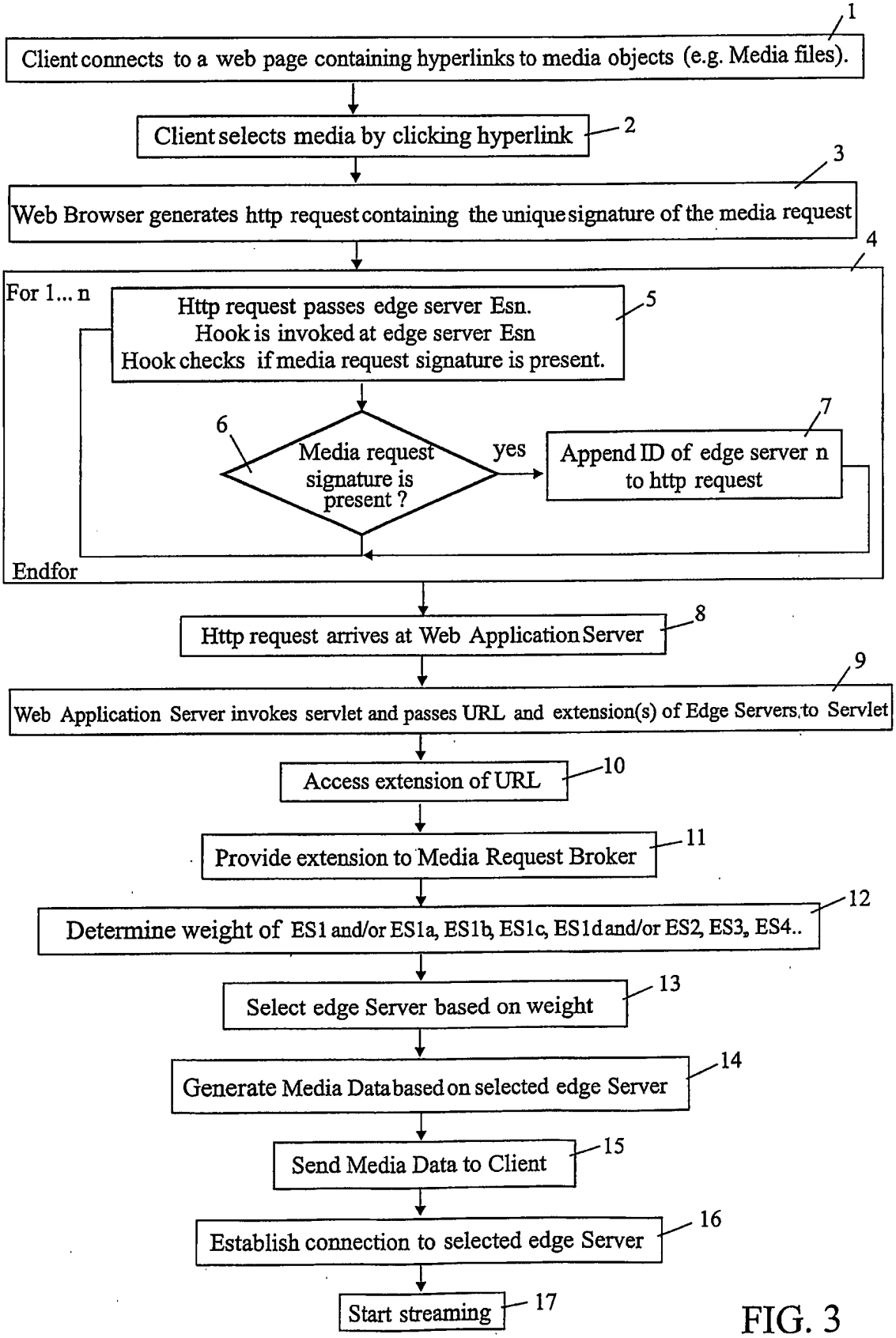
1
Client connects to a web page containing hyperlinks to media objects (e.g. Media files).
Client selects media by clicking hyperlink
2
3
Web Browser generates http request containing the unique signature of the media request
4
For 1... n
Http request passes edge server Esn.
Hook is invoked at edge server Esn
Hook checks if media request signature is present.
5
6
Media request signature is present ?
yes
7
Append ID of edge server n to http request
Endfor
Http request arrives at Web Application Server
8
9
Web Application Server invokes servlet and passes URL and extension(s) of Edge Servers to Servlet
Access extension of URL
10
Provide extension to Media Request Broker
11
Determine weight of ES1 and/or ES1a, ES1b, ES1c, ES1d and/or ES2, ES3, ES4..
12
Select edge Server based on weight
13
Generate Media Data based on selected edge Server
14
Send Media Data to Client
15
Establish connection to selected edge Server
16
Start streaming
17

FIG. 3

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 02/02947

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04L29/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 00 29990 A (INFOLIBRIA INC) 25 May 2000 (2000-05-25) abstract page 4, line 13 -page 7, line 25 page 9, line 3 -page 12, line 20	1,9
A	page 15, line 14 -page 16, line 19	2-8, 10-14

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 September 2002	17/09/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Stergiou, C

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 02/02947

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	DE BRA P M E ET AL: "Information retrieval in the World-Wide Web: Making client-based searching feasible" COMPUTER NETWORKS AND ISDN SYSTEMS, NORTH HOLLAND PUBLISHING. AMSTERDAM, NL, vol. 27, no. 2, 1 November 1994 (1994-11-01), pages 183-192, XP004037989 ISSN: 0169-7552 abstract page 187, column 1, line 18 -page 188, column 1, line 4 page 189, column 2, line 28, paragraph 3.3.1 -page 191, column 1, line 23, paragraph 4.3 ---	1-14
A	MOURAD A ET AL: "SCALABLE WEB SERVER ARCHITECTURES" PROCEEDINGS IEEE INTERNATIONAL SYMPOSIUM ON COMPUTERS AND COMMUNICATIONS, XX, XX, 1 July 1997 (1997-07-01), pages 12-16, XP000199852 abstract page 13, column 1, line 9, paragraph 2.1 -page 14, column 2, line 6, paragraph 2.2 -----	1-14

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP 02/02947

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0029990 A	25-05-2000	AU 1479500 A	05-06-2000
		EP 1131748 A1	12-09-2001
		WO 0029990 A1	25-05-2000